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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,366	07/21/2006	Masakazu Hirose	OBA-40858	9931
116	7590	10/06/2009	EXAMINER	
PEARNE & GORDON LLP			HOBAN, MATTHEW E	
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SUITE 1200			ART UNIT	PAPER NUMBER
CLEVELAND, OH 44114-3108			1793	
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			10/06/2009	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/597,366	HIROSE ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Matthew E. Hoban	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

1) Responsive to communication(s) filed on 6/3/2009.  
 2a) This action is **FINAL**.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

4) Claim(s) 1,4,5 and 7-20 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 1,4,5 and 7-20 is/are rejected.  
 7) Claim(s) \_\_\_\_\_ is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. _____ .
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)	5) <input type="checkbox"/> Notice of Informal Patent Application
Paper No(s)/Mail Date <u>8/4/09</u> .	6) <input type="checkbox"/> Other: _____ .

## DETAILED ACTION

### ***Previous Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 4-5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ise in his publication entitled "High Power Characteristics of Piezoelectric Ceramics in  $\text{Pb}(\text{Mn}_{1/3}\text{Nb}_{2/3})\text{O}_3$ - $\text{PbTiO}_3$ - $\text{PbZrO}_3$  System" in view of Tajimi in his publication entitled "Electric-Field induced Crack Growth Behavior in PZT/ $\text{Al}_2\text{O}_3$  Composites."

**Regarding Claim 1:** Ise teaches a range of compositions seen in Figure 4, where in this figure, the amount of PMnNO ( $\text{Pb}(\text{Mn}_{1/3}\text{Nb}_{2/3})\text{O}_3$ ) is plotted separately as a function of PZO ( $\text{PbZrO}_3$ ) content. The balance of the composition is PTO ( $\text{PbTiO}_3$ ). All components in the composition have the ABO<sub>3</sub> structure and are perovskite in nature. In figure 4, Ise shows many compositions falling within the claim. For example the first composition in the series containing 7.5% PMnNO has roughly a value of .4 for Z, .525 for y, .075 for x, and 1 for alpha.

Ise does not teach the use of an Al-containing phase in his composition.

However, Tajimi teaches that the addition of .5-1 vol%  $\text{Al}_2\text{O}_3$  is beneficial to PZT ceramics. The addition of this secondary phase reduces the stress concentrations in the ceramic and thus inhibits microcrack coalescence and the removal of PZT grains from the ceramic body. Tajimi noted better results at 1 vol% compared to .05 vol%. In his conclusion, Tajimi notes that piezoelectric and mechanical properties are not

inhibited by this addition, but the fatigue and durability of the composite is greatly increased. Therefore, one of ordinary skill in the art would see the teachings of Tajimi as highly beneficial and supplementary to those of Ise, and would be motivated to include the  $\text{Al}_2\text{O}_3$  taught by Tajimi based on the improved properties achieved by this addition. Furthermore, Tajimi and Ise are highly combinable in that they both deal with PZT ( $\text{Pb}(\text{Zr},\text{Ti})\text{O}_3$ ) piezoelectric compositions . Based on the approximation that the density of PZT is roughly two times that of alumina, this results in from ~.25-.5 wt% of alumina in the composition.

**Regarding Claim 4:** Tajimi teaches the addition of  $\text{Al}_2\text{O}_3$ .

**Regarding Claim 5:** Ise teaches a powder consolidation method and thus the sample is polycrystalline in nature. Tajimi teaches at page 652 that  $\text{Al}_2\text{O}_3$  particles are incorporated both within the grains and along the grain boundaries.

**Regarding Claim 7:** Tajimi does not test these properties in his disclosure; however, the composition of Ise in view of Tajimi would necessarily have these properties as it is of the same composition as that which is claimed. A composition of the same components and morphology cannot have mutually exclusive properties. See MPEP 2112.

***NEW Claim Rejections - 35 USC § 103***

5. Claims 1 and 8-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taiji in JP2001-181033.

**Regarding Claim 1 and 18-20:** Taiji teaches compositions of the formula  $[Pb_{a1}A_{a2}][(B1B2)]_x Ti_yZr_z\}O_3$ , wherein  $a1+a2$  is less than 1 but greater than .97;  $a2$  can be 0, while  $a1$  cannot;  $x+y+z=1$ ;  $x$ : .05-.4;  $y$ : .1-.5;  $z$ : .2-.6. Furthermore,  $B1$  is chosen from a group comprising Mn among other elements, and  $B2$  is chosen from a group comprising Nb among other elements. Therefore, the main component of Taiji's piezoelectric composition represents an overlapping range with the claimed composition. Although the disclosure of  $B1B2$  includes elements other than those claimed, certain combinations of these elements would immediately be deemed appropriate to one of ordinary skill in the art, one of which would be the  $Pb(Mn_{1/3}Nb_{2/3})O_3$  composition, which is a perovskite compound having mainly Pb, Zr, Ti, Mn and Nb. The number of appropriate piezoelectric, perovskite compositions that are appropriate under Taiji are therefore limited. Furthermore, the range of compositions of the main component of Taiji overlaps the claimed composition of the main component. Overlapping ranges have been held to create a *prima facie* case of obviousness over the prior art. Wherein, the claims have an overlapping set of ranges one of ordinary skill in the art would have been well equipped to choose from the overlapping portion of the ranges and arrive at the invention as claimed.

Taiji also teaches additives in his composition which can be chosen from a wide range and can be added in combination with one another. These additives amount to .001-1 wt% of the total composition weight. Among this group of possible additives is  $\text{Al}_2\text{O}_3$ . Therefore, the amount of  $\text{Al}_2\text{O}_3$  added to the composition of Taiji overlaps with the amount added to the instantly claimed piezoelectric ceramic. Overlapping ranges have been held to create a *prima facie* case of obviousness over the prior art. Wherein, the claims have an overlapping set of ranges one of ordinary skill in the art would have been well equipped to choose from the overlapping portion of the ranges and arrive at the invention as claimed (See Paragraph 7-8).

**Regarding Claim 8-10, 15 and 17:** Taiji teaches compositions of the formula  $[\text{Pb}_{a1}\text{A}_{a2}][(\text{B1B2})_x \text{Ti}_y\text{Zr}_z]\text{O}_3$ , wherein  $a1+a2$  is less than 1 but greater than .97;  $a2$  can be 0, while  $a1$  cannot;  $x+y+z=1$ ;  $x$ : .05-.4;  $y$ : .1-.5;  $z$ : .2-.6 (all ranges are inclusive). Furthermore,  $\text{B1}$  is chosen from a group comprising  $\text{Mn}$  among other elements, and  $\text{B2}$  is chosen from a group comprising  $\text{Nb}$  among other elements. Therefore, the main component of Taiji's piezoelectric composition represents an overlapping range with the claimed composition. Although the disclosure of  $\text{B1B2}$  includes elements other than those claimed, certain combinations of these elements would immediately be deemed appropriate to one of ordinary skill in the art, one of which would be the  $\text{Pb}(\text{Mn}_{1/3}\text{Nb}_{2/3})\text{O}_3$  composition. The number of appropriate piezoelectric, perovskite compositions that are appropriate under Taiji are therefore limited. Furthermore, the

range of compositions of the main component of Taiji overlaps the claimed composition of the main component. Overlapping ranges have been held to create a *prima facie* case of obviousness over the prior art. Wherein, the claims have an overlapping set of ranges one of ordinary skill in the art would have been well equipped to choose from the overlapping portion of the ranges and arrive at the invention as claimed.

Taiji also teaches additives in his composition which can be chosen from a wide range and can be added in combination with one another. These additives amount to .001-1 wt% of the total composition weight. Among this group of possible additives is  $Ta_2O_5$ . Therefore, the amount of  $Ta_2O_5$  added to the composition of Taiji overlaps with the amount added to the instantly claimed piezoelectric ceramic. Overlapping ranges have been held to create a *prima facie* case of obviousness over the prior art. Wherein, the claims have an overlapping set of ranges one of ordinary skill in the art would have been well equipped to choose from the overlapping portion of the ranges and arrive at the invention as claimed (See Paragraph 7-8).

**Regarding Claim 11-12 and 16:** Taiji teaches both  $Ta_2O_5$  and  $Al_2O_3$  as additives, wherein the list of additives can be used in combination, but can only be used in an amount from .01-1wt%. the amount of  $Ta_2O_5$  and  $Al_2O_3$  added to the composition of Taiji overlaps with the amount added to the instantly claimed piezoelectric ceramic. Overlapping ranges have been held to create a *prima facie* case of obviousness over

the prior art. Wherein, the claims have an overlapping set of ranges one of ordinary skill in the art would have been well equipped to choose from the overlapping portion of the ranges and arrive at the invention as claimed (See Paragraph 7-8).

**Regarding Claim 13:** Taiji teaches both  $Ta_2O_5$  and  $SiO_2$  as additives, wherein the list of additives can be used in combination, but can only be used in an amount from .01-1wt%. the amount of  $Ta_2O_5$  and  $SiO_2$  added to the composition of Taiji overlaps with the amount added to the instantly claimed piezoelectric ceramic. Overlapping ranges have been held to create a *prima facie* case of obviousness over the prior art. Wherein, the claims have an overlapping set of ranges one of ordinary skill in the art would have been well equipped to choose from the overlapping portion of the ranges and arrive at the invention as claimed (See Paragraph 7-8).

**Regarding Claim 14 and 15:** Taiji does not test the claimed properties in his disclosure; however, the composition of Taiji would necessarily have these properties as it is of the same composition as that which is claimed. A composition of the same components and morphology cannot have mutually exclusive properties. See MPEP 2112.

#### ***Response to Arguments***

6. Applicant's arguments filed 6/03/09 have been fully considered but they are not persuasive. Applicant argues that the combination of Ise and Tajima is not supported by

Ise's ability to remedy a problem seen in Tajima. However, the addition of Tajima to Ise is to improve the properties of the piezoelectric and extend its service cycle. One of ordinary skill would find it obvious that the addition of a component that inhibits crack generation and propagation as beneficial to a composition that undergoes loads. Furthermore, there is a reasonable expectation that this benefit can be attained in the composition of Ise based on the fact that several similar piezoelectrics attain the same effect when alumina is added in minor proportions. Applicant is directed to paragraph 21 of 2006/0043329 which cites the fact that alumina causes PMgN-PZT piezoelectric composition of his teachings to achieve higher strength. These same results are seen in Table I of Ise. Therefore, as it has been shown that the addition of alumina to different piezoelectrics of the same family as PMnN-PZT, one would be reasonable in expecting the same effects as those seen in both PZT and PMgN-PZT. This data would clearly give one of ordinary skill a reasonable expectation that the addition of alumina would achieve the same beneficial properties.

7. Applicant argues that the differences shown in Ise by the replacement of Sb by Nb in the main component of the piezoelectric is a smaller change than the addition of .5 wt% of an additive. This is an unreasonable assertion as a change in the piezoelectric composition is a much larger change than the addition of a minority phase as taught by Tajima. Applicant goes on to argue that  $v_{max}$  would increase with the addition of alumina. The property  $v_{max}$  is neither claimed and there has been no evidence provided that this would occur.

***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Hoban whose telephone number is (571) 270-3585. The examiner can normally be reached on Monday - Friday from 7:30 AM to 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerry Lorengo can be reached on (571) 272-1233. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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